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(54) **ION EXCHANGING APPARATUS**

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(Continued)

(56)

**References Cited**

U.S. PATENT DOCUMENTS

1,613,746 A \* 1/1927 Eisenhower ..... B01D 29/0018  
210/289

2,217,692 A \* 10/1940 McGill ..... C02F 1/004  
210/123

(Continued)

FOREIGN PATENT DOCUMENTS

DE 2030050 11/1971  
EP 0002342 A1 6/1979

(Continued)

OTHER PUBLICATIONS

Machine Language Translation of FR1000096A (Traitment Des Liquides), Feb. 1952, Retrieved from the internet on Aug. 3, 2016, <URL: <https://worldwide.espacenet.com>>, 3 pages.\*

(Continued)

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(57)

**ABSTRACT**

The present invention aims at limiting the pressure loss and smoothly discharging water treated by ion exchangers to the outside of the apparatus. Ion exchanging apparatus 1 has outer vessel 3 that has inner space 2; and ion exchanger support 4 that separates at least a part of inner space 2 into upper space 2a and lower space 2b and that can support ion exchangers to be loaded in upper space 2a. At least a part of an upper surface of the ion exchanger support is made from at least one screen which supports the ion exchangers and

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